# Gender in Problem Based Learning: Curiosity Analysis, Problem Understanding, and Problem Solving Ability

 **1\* Yusuf, 2 Hunaepi**

Mataram State Islamic University (UIN) . Jl. Gajah Mada No. 100, Jempong Baru, BaruKec. Sekarbela, Mataram City, West Nusa Tenggara. 83116

Biology Education Study Program , Faculty Engineering and Applied Science , Mandalika University of Education . Jl. Youth No. 59A, Mataram, Indonesia . Postal code: 83125

\*Corresponding Author e-mail : yusuf\_msaleh@uinmataram.ac.id

Received:… ………..; Revised:…………; Published: …………..

**Abstract**

Research objectives This is analyze the effect of problem-based learning and gender on students' curiosity, problem understanding, and problem-solving abilities. The study was conducted in two classes of Mataram Model X Madrasah Aliyah students, who were taken using cluster random sampling technique. Data on students' curiosity were measured by questionnaires, problem understanding, and students' problem solving abilities were measured by test instruments and then analyzed by MANOVA at a significance level of 5%. The results showed that problem-based learning had a significant effect on curiosity and problem solving abilities , but did not have a significant effect on problem comprehension . The curiosity of male students is higher than that of female students, but the opposite occurs in the conventional group in classes taught with problem-based learning. The problem comprehension of male students was lower than that of female students in both study groups. problem solving of female students is higher than the group of male students. However, gender has no significant effect on curiousity, problem comprehension , and problem solving ability . The interaction of problem-based learning and gender has no significant effect on curiousity problem comprehension and problem solving abilities .

***Keywords:*** *Gender; based problem ; Desire know ; understanding Problem*

***How to Cite:*** First author., Second author., & Third author . (20xx). The title . *Prisma Sains: Journal of the Study of Science and Learning Mathematics and Science IKIP Mataram, vol* ( no ), xx- yy . doi: [https://doi.org/10.33394/j-ps.v xx i yy](https://doi.org/10.33394/j-ps.vxxiyy)

|  |  |
| --- | --- |
| [https://doi.org/10.33394/j-ps.v xx i yy](https://doi.org/10.33394/j-ps.vxxiyy) | Copyright *©* 2019, First author et alThis is an open-access article under the [CC-BY License](http://creativecommons.org/licenses/by/4.0/) .Creative Commons License |

**INTRODUCTION**

In the current era, the world of work is increasingly realizing the importance of gender equality and embracing diversity in the workplace. Many organizations and companies are actively looking for ways to increase women's participation in jobs previously dominated by men, such as the fields of technology or science. In addition, practices such as work flexibility and family leave are also being increasingly implemented to help men and women meet the demands of their work and family responsibilities.

However, there are still challenges in achieving gender equality in the workplace (Stamarski & Son Hing, 2015) , such as the wage gap that still exists between men and women in several fields, as well as perceptions that still exist in society about gender roles in workplaces. work . Therefore, concrete efforts and actions are still needed from organizations, governments, and society at large to achieve gender equality and embrace diversity in the workplace.

The ability to understand problems, curiosity, and problem-solving skills are very important in the 21st century for both men and women (Hunaepi et al., 2021a, 2021b; Malik et al., 2019) . This will help individuals to face complex challenges in real life, compete in a rapidly changing global environment, develop innovative solutions, solve social problems, and achieve career success. Therefore, it is important for individuals to develop these abilities through effective education and learning.

Today's life is increasingly complex and rapidly changing, and often requires problem understanding, curiosity, and problem-solving skills to deal with it. Whether in the context of work, education or everyday life, this ability can help individuals find creative and innovative solutions to the problems they face. Global competition is getting tougher, and individuals who have good problem understanding, curiosity, and problem solving skills will be better able to compete and adapt to a rapidly changing global environment. Innovation and technology: Innovation and technology are advancing at a rapid pace, and problem understanding, curiosity, and problem-solving skills are essential for developing new technologies and innovative solutions to existing problems. Social problems such as poverty, climate change and social inequality are increasingly complex and require problem understanding, curiosity and problem-solving skills to find effective solutions. The ability to understand problems, curiosity, and problem-solving skills are very important to achieve success in careers, both in the private and public sectors.

Curiosity is a desire within oneself to find out about an object or event that occurs, which is obtained through auditory observation or measurement (Nurdiana et al., 2023; Suhirman et al., 2022). Understanding of a problem is one's knowledge of the ins and outs of a problem that concerns what, why, and how a problem occurs. Problem solving is a person's ability to find alternative solutions to make a problem have a way of solving, trying out these alternative solutions so that it can be proven that the solutions offered can really solve the problem at hand.

Women and men are valued equally in all workplaces and academic contexts. This was mobilized in participant narratives to suggest that gender is not important, instead that school and workplace experiences are about the individual, thus making it 'no problem' for women to enter male-dominated areas such as engineering.

Today's world of work no longer distinguishes gender as a priority in determining position. A woman who was previously doubted in terms of leadership, has now been given an open space to lead a unit or institution and even the government. People who work in an organization can work well and lead successfully when the knowledge, attitudes, and work skills are fully owned and applied in their work environment.

The world of work is increasingly recognizing the importance of gender equality and embracing diversity in the workplace. Many organizations and companies are actively looking for ways to increase women's participation in jobs previously dominated by men, such as the fields of technology or science.

However so , still there is challenge in reach gender equality in place work , like gap still wages There is between boy and girl in a number of field, as well still perception exist in society about gender roles in place work . In some culture , man considered superior than Woman in matter intelligence and abilities . this impact on perception public to ability Woman in various field , incl ability solving problem . Women often pushed For take role traditional like nurse children and family , meanwhile man pushed For chase career and earn money . this can impact on perception public to ability Woman in matter ability solving problem . Gender stereotypes that develop in society can also affect perception public to ability solving problem girl. For example, the stereotype that says that Woman tend more emotional and lacking logical, so considered not enough capable in matter solving problem .

Because it, still needed effort give description results study How ability academic boy and girl to public in a manner wide For reach gender equality and embracing on- site diversity work . Era Industry 4.0 requires ability somebody For Can solve problem. demands This must fulfilled by educational institutions . Learning must facilitate grow the flower ability student in understand something problem solve problem and arouse curiosity know student. Various innovation must Keep going done For encourage and train curiosity, ability understand problems and skills solve problem . Strategy related learning with competence the is a learning model based problem. Problem-Based Learning (PBL) is a learning model that focuses on solving real problem in real world situation or relevant context with student (Guo et al., 2020; Mirawati et al., 2017) . In the PBL method , students will given A problem or must situation solved with method Work The same in group For look for solution best ( Suaedin et al., 2014). In the PBL learning process, the teacher does not Again role as giver knowledge, but as facilitator and mentor For help student develop ability solving problem, work same, and thought critical .

PBL theory is based on the concept constructivism says that student will more active in learning If they build knowledge Alone through experience and interaction with environment around ( Trullàs et al., 2022) . Besides In addition , PBL is also based on theory Study stressed social importance interaction social and work The same in learning .

Study This done For test How learning based problem affect curiosity, understanding problem , and solving problem student to student male and female and uncover how do you want know , understanding problems and abilities solving problem student boy and girl when faced with the same problem .

A number of study show that (Eko et al., 2018; Laili et al., 2019; Malik et al., 2019) . PBL can increase students' curiosity, problem understanding, and problem solving abilities. PBL provides opportunities for students to learn through experience and exploration, so as to increase students' curiosity about the material being studied. In addition, PBL also encourages students to develop problem solving abilities through critical and creative thinking processes in solving given problems. However, this research has not revealed how the abilities of male and female students. This study analyzes students' curiosity, problem understanding, and problem-solving abilities based on gender in problem-based learning.

**METHODS**

This research is a quasi-experimental study with a breathment by level 2 x 2 design. The research was conducted at the Mataram Model Madrasah Aliyah. Two experimental group classes and two control group classes were taken by *cluster random sampling technique* . The learning treatment is; problem-based learning/PBL (A1, consisting of 38 students ) and conventional learning (A2, consisting of 38 students) given to groups of male students (B1) and female students (B2).

Group A1 was given learning with a problem-based learning strategy A2 was given conventional learning according to what was planned by the biology teacher on environmental change material.

Treatment is a problem-based learning strategy that includes; PBL-based lesson plans, student worksheets, and experimental materials. Learning in both experimental and control classes was carried out by the same teacher, namely the biology subject teacher at the madrasah. During learning in the two groups, observations were made on the implementation of learning to ensure that learning took place according to plan.

After the lesson was completed which lasted four meetings, the final measurement was carried out on students' understanding of the problem, student curiosity, and student problem solving skills. Students' understanding of the problem was measured by test questions (reliability = 0.95), students' curiosity was measured by self-assessment sheets (reliability 0.81), and students' problem solving skills in the form of essay tests (reliability 0.81).

Data on student comprehension test scores, curiosity self-assessment scores, and student problem-solving skills test scores were analyzed using descriptive and inferential statistics. Descriptive statistical analysis to get an overview of the parameter trends (mean value, highest value, standard deviation, and category) of students' understanding of problems, self-assessment of curiosity, and students' problem solving skills between the experimental group and the control group. Categorizing students' understanding of problems, students' curiosity, and students' problem solving skills using benchmark reference assessment standards (PAP), namely 86-100 (very high), 71-85 (high), 56-70 (moderate), 40- 55 (low), and 0-39 (very low) (Trianto & Suseno, 2017) . Inferential statistics using manova to test the research hypothesis at a significance level of 0.05.

There are three hypotheses tested, namely: (1) The problem-based learning model has a significant effect on students' understanding of problems, students' curiosity, and students' problem solving skills, (2) Gender has a significant effect on students' understanding of problems, curiosity students, and students' problem solving skills, and (3) problem-based and gender-based learning models, together have a significant effect on students' understanding of problems, students' curiosity, and students' problem solving skills.

**RESULTS AND DISCUSSION**

Measurement of *curiosity* was carried out after the learning treatment in the two study groups. Student *curiosity* data is presented in Table 1.

**table** 1 . Comparison Curiosity Score in Groups Study

| Groups | Gender | Means | std. Deviation | N | Category |
| --- | --- | --- | --- | --- | --- |
| A1(PBL) | B1 (Male) | 3.2223 | .24970 | 13 | high |
| B2 (Female) | 3.0400 | .28117 | 25 | high |
| Total |  |  |  | high |
| A2(Conventional) | B1 (Male) | 2.6669 | .85553 | 13 | Medium |
| B2 (Female) | 2.8716 | .40000 | 25 | high |
| Total | 2.8016 | .59233 | 38 | high |
| Total | B1 (Male) | 2.9446 | .67931 | 26 | high |
| B2 (Female) | 2.9558 | .35259 | 50 | high |
| Total | 2.9520 | .48484 | 76 | high |

Table 1 shows that there is a difference in the average curiosity score of students in the PBL group and the conventional group. The average curiosity score of students in the PBL group was higher than the conventional group. This shows that the curiosity of students who are taught with problem-based learning is better than conventional learning. Besides it's on the results analysis This shows the difference in the average curiosity score of male (B1) and female (B2) groups in groups A1 and A2. In the PBL group, the average curiosity of male students (B1) was higher than female students (B2), but in the conventional group, the average curiosity of male students (B1) was lower than female students (B2).

The distribution of male and female students based on the curiosity category shows variations. An overview of the trend of gender percentage data in the curiosity category of PBL and conventional classes is presented in Table 2 and Figure 1.

Table 2 . Gender Portion in Group Curiosity Category Study

|  |  |  |
| --- | --- | --- |
|   | PBL | Conventional |
|   | Male | Female | Male | Female |
| Categories | f | % | f | % | f | % | f | % |
| Very High | 1 | 7,7 | 1 | 4 | 0 | 0 | 1 | 4 |
| high | 10 | 77 | 16 | 64 | 6 | 46 | 7 | 28 |
| Medium | 2 | 15 | 7 | 28 | 4 | 31 | 10 | 40 |
| Low | 0 | 0 | 1 | 4 | 1 | 7,7 | 7 | 28 |
| Very Low | 0 | 0 | 0 | 0 | 2 | 15 | 0 | 0 |
| Total | 13 | 100 | 25 | 100 | 13 | 100 | 25 | 100 |

Table 2 shows that the percentage of male students who have very high and high curiosity categories is greater than female students. The results were found in two study groups. There were no male students in the PBL group who were included in the Low and Very Low categories.

Figure 1 . Comparison Portion Student Boys and Girls inside curiocity in groups research .

**Figure** 1 shows that male students are more in the high curiosity category in the PBL group and the conventional group. Learning with PBL encourages male students to have more curiosity than female students.

*Problem Comprehension*

problem comprehension refers to their ability to analyze facts and phenomena that occur in the observed environment. The problem understanding test was carried out after the learning treatment. Data on students' problem comprehension scores are presented in Table 3.

**table** 3 . Comparison Group Problem Comprehension Score Study

| Groups | Gender | Means | std. Deviation | N | Category |
| --- | --- | --- | --- | --- | --- |
| A1(PBL) | B1 (Male) | 74.7246 | 9.93822 | 13 | high |
| B2 (Female) | 78.5716 | 8.80891 | 25 | high |
| Total | 77.2555 | 9.26213 | 38 | high |
| A2(Conventional) | B1 (Male) | 67.3069 | 22.95400 | 13 | Medium |
| B2 (Female) | 75.5700 | 12.27221 | 25 | high |
| Total | 72.7432 | 16.86286 | 38 | high |
| Total | B1 (Male) | 71.0158 | 17.73753 | 26 | high |
| B2 (Female) | 77.0708 | 10.68044 | 50 | high |
| Total | 74.9993 | 13.70263 | 76 | high |

Table 3 shows that there is a difference in the average problem comprehension scores of students in the PBL research group and the control group. The average score for understanding the problems of students in the PBL group was higher than the conventional group. This shows that the problem comprehension of students who are taught with PBL is better than conventional learning.

Table 3 also shows a comparison of the average comprehension problem scores of students in the male (B1) and female (B2) groups in groups A1 and A2. The average problem comprehension of male students (B1) was lower than that of female students (B2) in both study groups. These results show that the problem comprehension of female students is higher than that of the male group.

The results of the study also show that PBL is able to encourage many students in the very high and high categories compared to conventional learning. Comparison of student frequency based on problem comprehension categories in the study group is presented in Table 4 and Figure 2.

Table 4 . Gender Portion in Group Problem Comprehension Categories Study

|  |  |  |
| --- | --- | --- |
|   | PBL | Conventional |
|   | Male | Female | Male | Female |
| Categories | f | % | f | % | f | % | f | % |
| Very High | 1 | 7,7 | 5 | 20 | 1 | 7,7 | 3 | 12 |
| high | 9 | 69 | 16 | 64 | 7 | 54 | 14 | 56 |
| Medium | 3 | 23 | 4 | 16 | 4 | 31 | 8 | 32 |
| Low | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Very Low | 0 | 0 | 0 | 0 | 1 | 7,7 | 0 | 0 |
| Total | 13 | 100 | 25 | 100 | 13 | 100 | 25 | 100 |

Table 4 shows that the percentage of female students who have problem comprehension categories is very high and the height is greater than male students. The results were found in two study groups. There were no male students in the PBL group who were included in the Low and Very Low categories.

Figure 2 . Comparison Portion Student Boys and Girls in problem comprehension in groups research .

*2* shows that more female students fall into the category of very high *problem comprehension* in the PBL and conventional groups. Learning with PBL encourages female students to have *a better problem comprehension than* male students. Measurement of *problem solving was carried* out after treating learning in the two research groups. Student *problem solving* data is presented in Table 1 *.*

Table 5 . Comparison Problem Solving Scores in Groups Study

| Groups | Gender | Means | std. Deviation | N | Category |
| --- | --- | --- | --- | --- | --- |
| A1(PBL) | B1 (Male) | 72.8231 | 11.05442 | 13 | high |
| B2 (Female) | 78.1320 | 12.39905 | 25 | high |
| Total | 76.3158 | 12.07760 | 38 | high |
| A2(Conventional) | B1 (Male) | 40,0000 | 17.43775 | 13 | Medium |
| B2 (Female) | 38.6600 | 16.65836 | 25 | high |
| Total | 39.1184 | 16.70433 | 38 | high |
| Total | B1 (Male) | 56.4115 | 22.01645 | 26 | high |
| B2 (Female) | 58.3960 | 24.67138 | 50 | high |
| Total | 57.7171 | 23.66732 | 76 | high |

Table 5 shows that there is a difference in the average score of problem solving abilities in the students in the PBL study group and the control group. The average problem solving score of students in the PBL group was higher than the conventional group. This shows that the problem solving of students who are taught with PBL is better than conventional learning.

Table 3 also shows a comparison of the average problem solving scores of students in the male (B1) and female (B2) groups in groups A1 and A2. In the PBL group, the average problem solving score of female students (B2) was higher than that of male students (B1). These results indicate that the problem solving group of female students is higher than that of male students.

The results of the study also show that PBL is able to encourage many students in the very high and high categories compared to conventional learning. Comparison of student frequency based on problem comprehension categories in the study group is presented in Table 6 and Figure 3.

Table 6 . Gender Portion in Group Problem Solving Categories Study

|  |  |  |
| --- | --- | --- |
|   | PBL | Conventional |
|   | Male | Female | Male | Female |
| Categories | f | % | f | % | f | % | f | % |
| Very High | 3 | 23 | 12 | 48 | 0 | 0 | 0 | 0 |
| high | 5 | 38 | 6 | 24 | 0 | 0 | 2 | 8 |
| Medium | 4 | 31 | 7 | 28 | 3 | 25 | 3 | 12 |
| Low | 1 | 7,7 | 0 | 0 | 3 | 25 | 4 | 16 |
| Very Low | 0 | 0 | 0 | 0 | 6 | 50 | 16 | 64 |
| Total | 13 | 100 | 25 | 100 | 12 | 100 | 25 | 100 |

Figure 3 . Comparison Portion Student Boys and Girls inside problem solving abilities in groups research .

Figure 3 shows the percentage of women who reach the problem *ability category* *s* olving very high and very high high. There were female students who entered the category of very high *problem solving abilities in both research groups, but* male students could not achieve that. Learning *with* PBL encourages female students to have more problem solving skills *than male* students.

After the data is presented with descriptive statistics, then the research hypothesis test is performed . Before the hypothesis test is carried out, the prerequisite test is carried out first, namely the data normality test and the homogeneity test. Data normality test results are presented in Table 7 and homogeneity test results are presented in Table 8.

Table 7 . Normality test results

| **treatment** | **Statistics** | **Sig.** |
| --- | --- | --- |
| A1B1 | 0.163 | 0.200 \* |
| A1B2 | 0.318 | 0.073 |
| A2B1 | 0.183 | 0.200 \* |
| A2B2 | 0.223 | 0.134 |

Based on Table 7, the four treatments have statistical value with Sig. value greater than 0.05. Therefore, data for all treatments were declared normally distributed.

**table** 8 . Homogeneity Test Results

| **F** | **Sig.** |
| --- | --- |
| 2,909 | 0.066 |

Table 8 shows that the Levene's Test of Equality of variances have F-value with Sig. value greater than 0.05. Therefore, groups were declared to have a homogeneous variance.

After the data is declared normal and homogeneous, hypothesis testing is carried out. Test the hypothesis with ANOVA using SPSS 16.0 to see the Main Effect and Simple Effect at a significance of 0.05. The results of the analysis are presented in Table 9.

**Table 9.** Results of *Tests of Between-Subjects Effects*

| Source | Dependent Variables | Type III Sum of Squares | df | MeanSquare | F | Sig. |
| --- | --- | --- | --- | --- | --- | --- |
| Corrected Model | Curiousity | 2.362a \_ | 3 | .787 | 3,712 | .015 |
| Problem Comprehension | 1097,401b \_ | 3 | 365,800 | 2028 | .118 |
| Problem Solving | 26545650c \_ | 3 | 8848550 | 41,196 | .000 |
| Intercepts | Curiousity | 595,518 | 1 | 595,518 | 2.808E3 | .000 |
| Problem Comprehension | 375112.126 | 1 | 375112.126 | 2.080E3 | .000 |
| Problem Solving | 225460555 | 1 | 225460555 | 1.050E3 | .000 |
| Groups | Curiousity | 2,240 | 1 | 2,240 | 10,564 | 002 |
| Problem Comprehension | 464,244 | 1 | 464,244 | 2,574 | .113 |
| Problem Solving | 22350499 | 1 | 22350499 | 104057 | .000 |
| Gender | Curiousity | 002 | 1 | 002 | 010 | .920 |
| Problem Comprehension | 627,137 | 1 | 627,137 | 3,477 | .066 |
| Problem Solving | 67,362 | 1 | 67,362 | .314 | .577 |
| Groups \* Gender | Curiousity | .640 | 1 | .640 | 3.020 | 087 |
| Env. Knowld | 83,396 | 1 | 83,396 | .462 | .499 |
| Problem Solving | 189,048 | 1 | 189,048 | .880 | .351 |

Table 9 shows; (1) PBL has a significant effect on curiosity (F = 10.564, *p* = 0.002) and *problem solving* ability *(F =* 104.057, *p* = 0.000), but does not have a significant effect on *problem comprehension (F =* 2.574 *, p =* 0.113 ). (2) Gender has no significant effect on curiosity (F = 0.010, *p =* 0.920), *problem comprehension (F =* 3.477 *, p = 0.066* ), and *problem solving* ability *( F = 0.314* , *p* = 0.577 ) *. 0.499* ) *problem solving* ability *(F = 0.880* , *p* = 0.351).

The average curiosity score of students in the PBL group was higher than the conventional group. Curiosity of students who are taught with problem-based learning is better than conventional learning. In the PBL group, the average curiosity of male students (B1) was higher than female students (B2), but in the conventional group, the average curiosity of male students (B1) was lower than female students (B2).

The curiosity of students in the PBL group rose when they were faced with authentic problems that were around them during the student orientation stage on the problem. Learning that begins with presenting pictures and stories about environmental phenomena that are damaged, such as photos of fish that have died because they live in pool water affected by detergent waste, can encourage students' curiosity. Seeing the impressions of various problems around their environment, students become curious and provoked to ask questions about what, why, and how this phenomenon occurs.

Problem-based learning gives space for students to analyze problems, find out what causes problems, think about alternative solutions. Students are given the opportunity to try out their ideas, propose that the solutions they provide will solve a problem. Students conduct an experiment, control all the variables involved in their experiment, observe small changes in their experimental group, record the necessary data, and analyze it until they arrive at a decision that the solution idea they offer has been experimentally tested with conclusive results. In PBL they are also given the opportunity to re-check the problem-solving process when they find that their assumptions are different from the experimental results. Learning activities like this cause students to dissolve in an atmosphere following the flow of their curiosity. They are involved in work to answer their curiosity about a problem.

The data also shows variations in the distribution of male and female students based on the curiosity category. The percentage of male students who have a very high and high curiosity category is greater than female students. The results were found in two study groups. There were no male students in the PBL group who were included in the low and very low categories. This result is influenced by PBL which gives students the opportunity to solve authentic problems through discussions about how they will find answers to questions or solve given environmental problems, seeking information or supporting knowledge from various sources such as the internet which enables students to be technologically literate. Learners are accustomed to finding and selecting the necessary information from the amount of information obtained from various learning sources. After obtaining the necessary information, students have an understanding of environmental conservation .

The content of the problems presented in learning also had an effect on the high average scores and curiosity categories in the PBL group . According to (Boelens et al., 2015) , in problem-based learning, the quality of problems has a role in stimulating students in learning. In problem-based learning, learning begins by confronting students with authentic problems regarding the environment. Students are asked to analyze the problems presented in news and pictures, for example the problem of how abiotic components affect biotic components. This activity encourages students to ask questions, always arouse curiosity, dig, trace, and investigate various things that have not yet found answers, and spy, peek, and uncover various things that are still unclear.

Curiosity always leaves curiosity (Pramiasari et al., 2022) . It is this curiosity that can make someone always ask questions and raise concerns about something they want to know. That's why they love to explore, learn, and discover new things that have never been found before

There was a difference in the average problem comprehension scores between the students in the PBL research group and the control group. The average score of problem comprehension in the PBL group was higher than that of the conventional group. This shows that the problem comprehension of students who are taught with PBL is better than conventional learning.

Understanding the problems of students taught with PBL tends to be better because this approach provides a more real and contextual learning experience. In PBL, students are given real-world tasks or problems that they must solve through a process of investigation and reflection. Students are expected to understand the context of the problem thoroughly and find effective solutions. Experiential learning: In PBL, students learn through hands-on learning experiences gained from carrying out real-world tasks or problems. Students participate actively in finding information and solving the problems they face. This helps students to understand problems more deeply and encourages them to take initiative in the learning process. In conclusion, the problem understanding of students taught with PBL tends to be better because this approach provides a more real and contextual learning experience. In PBL, students learn through hands-on learning experiences gained from carrying out real-world assignments or problems, working in diverse groups, and periodically reflecting on their learning experiences. All these factors help students to understand problems more deeply and find effective solutions

The average problem comprehension of male students was lower than that of female students in both study groups. These results show that the problem comprehension of female students is higher than that of the male group. The percentage of female students who have problem comprehension categories is very high and the height is greater than male students. The results were found in two study groups. There were no male students in the PBL group who were included in the low and very low categories.

In PBL learning, the problem understanding of female students can be higher than that of male students due to the following factors: Better verbal skills: Female students tend to excel in verbal skills, such as reading and writing. This can help them process information related to problems and communicate their ideas more clearly and effectively. Female students tend to have better social and emotional skills than male students, such as the ability to communicate and work together in groups. In PBL, female students can more easily collaborate with their group members to solve problems and achieve better results. More active involvement in learning: Female students tend to engage more in activities that involve social interaction and providing input. This can help them in learning PBL which emphasizes learning through collaboration and discussion between students. However, it is so, that the differences in problem understanding between female and male students in PBL learning are not absolute and can vary for each individual. It is important for teachers to pay attention to individual needs and learning styles so that each student can have equal opportunities to learn and develop

There is a difference in the average score of problem solving abilities in students in the PBL study group and the conventional group. The average problem solving score of students in the PBL group was higher than the conventional group. This shows that the problem solving of students who are taught with PBL is better than conventional learning.

Student-centered learning: In PBL, students are actively involved in finding solutions to a given problem, so that they are more responsible for their own learning. This can increase their self-confidence, motivation, and problem-solving skills. Real problem context: Problems given in PBL are usually related to real situations, so students can understand how the concepts learned can be applied in everyday life. This allows students to develop more relevant and significant problem-solving skills. Improved collaboration skills: PBL involves working together in groups to solve problems, so students can learn to communicate well, lead and follow, and develop better social skills. Collaboration can help students gain a broader perspective and be more creative in solving problems. Emphasis on process and continuous problem solving: In PBL, it is not only solving problems, but also paying attention to the process for solving those problems. Students can learn about problem solving strategies, identify and solve problems, and evaluate the resulting solutions. This can improve students' problem solving skills on an ongoing basis. With a combination of these characteristics, PBL can help students develop better problem-solving abilities, as well as improve motivation, social skills, and concept comprehension skills.

When a person has the ability to understand a problem, it tends to make it easier for him to determine alternative solutions, seek theoretical support, seek empirical support, determine the stages of solving, and plan work in solving the problem. When students have high curiosity they tend to want to find what, why, and how a problem occurs and how a problem can be solved. Someone who has high curiosity will have high foresight in seeing a phenomenon or an object that occurs. They tend to connect an event with another event and relate a concept to the event or connect it to previous events and predict future events.

After going through that process a person becomes able to better understand a problem. By understanding a problem, they will easily determine the formula for solving the problem.

In the PBL group, the average problem solving score of female students (B2) was higher than that of male students (B1). These results indicate that the problem solving ability of female students is higher than that of male students.

The higher problem-solving abilities of female students compared to male students in PBL learning can be influenced by several factors, including: Cognitive differences: Several studies have shown that in general, girls tend to be better at verbal, analytical, and reflective abilities, males tend to be better at spatial and mechanical abilities. Better analytical and reflective abilities in female students can help them understand problems and develop effective problem-solving strategies. Learning characteristics: Girls students tend to be more organized and prefer to learn collaboratively, while boys prefer to learn competitively and independently. The learning characteristics of female students who are more organized and like to learn collaboratively can help them develop better problem-solving skills through working with group mates.

Social and cultural factors: Female students in some cultures may benefit more in terms of education and developing problem-solving skills as they are often expected to be more organized and studious, as well as receive social support from family and peers .

**CONCLUSION**

Problem-based learning has a significant effect on curiosity (F = 10.564, *p* = 0.002) and *problem solving* ability *(F =* 104.057, *p* = 0.000), but does not have a significant effect on *problem comprehension (F =* 2.574 *, p = 0.113* ) . The curiosity of male students is higher than that of female students, but the opposite occurs in the conventional group in classes taught with problem-based learning. The problem comprehension of male students was lower than that of female students in both study groups. problem solving of female students is higher than the group of male students. However, gender did not have a significant effect on curiousity (F = 0.010, *p = 0.920), problem comprehension* ( *F =* 3.477 *, p =* 0.066), and *problem solving* ability *(F = 0.314 ,* p *=* 0.577). The interaction of problem-based learning and gender has no significant effect on curiousity (F = 3.020, *p = 0.087 problem comprehension* ( *F =* 0.462 *, p =* 0.499) *problem solving* ability *(F = 0.880* , *p* = 0.351).

**RECOMMENDATIONS**

Curiosity, problem understanding, and problem-solving abilities of female students can surpass male students if given intentional intervention in learning. Because, in learning conditions that do not differentiate between the treatment of students based on gender in PBL learning, the understanding of problems and problem-solving abilities of female students can still be higher than male students. However, keep in mind that this research was only conducted on certain samples and may not necessarily be generalizable to the population as a whole. Therefore, further research is needed to strengthen these findings.

**REFERENCES**

Boelens, R., Wever, B. D., Rosseel, Y., Verstraete, A. G., & Derese, A. (2015). What are the most important tasks of tutors during the tutorials in hybrid problem-based learning curricula ? *BMC Medical Education*, *15*(84), 1–8. https://doi.org/10.1186/s12909-015-0368-4

Eko, Y. S., Prabawanto, S., & Jupri, A. (2018). The role of writing justification in mathematics concept: The case of trigonometry. *Journal of Physics: Conference Series*, *1097*, 12146. https://doi.org/10.1088/1742-6596/1097/1/012146

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, *102*, 101586. https://doi.org/10.1016/j.ijer.2020.101586

Hunaepi, H., Ikhsan, M., Suwono, H., & Sulisetijono, S. (2021a). Contribution of Epistemic Curiosity and its Relevance to Science Process Skills on Biology Prospective Teacher. *Jurnal Penelitian Pendidikan IPA*, *7*(SpecialIssue), 112–117. https://doi.org/10.29303/jppipa.v7iSpecialIssue.1070

Hunaepi, H., Ikhsan, M., Suwono, H., & Sulisetijono, S. (2021b). Curiosity in Learning Biology: Literature Review. *Prisma Sains : Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *9*(2), 343–353. https://doi.org/10.33394/j-ps.v9i2.4272

Jain, T., & Jamali, D. (2016). Looking Inside the Black Box: The Effect of Corporate Governance on Corporate Social Responsibility: Mapping the Effect of CG on CSR. *Corporate Governance: An International Review*, *24*(3), 253–273. https://doi.org/10.1111/corg.12154

Laili, H., Hamid, A., & Abdullah, A. (2019). Cultivating Students’ Interest and Positive Attitudes towards Indonesian Language through Phenomenon-Text-Based Information Literacy Learning. *International Journal of Instruction*, *12*(2), 147–162. https://doi.org/10.29333/iji.2019.12210a

Malik, A., Yuningtias, U. A., Mulhayatiah, D., Chusni, M. M., Sutarno, S., Ismail, A., & Hermita, N. (2019). Enhancing problem-solving skills of students through problem solving laboratory model related to dynamic fluid. *Journal of Physics: Conference Series*, *1157*, 32010. https://doi.org/10.1088/1742-6596/1157/3/032010

Mirawati, B., Meilani, R., & Hunaepi, H. (2017). Pengaruh Model Pembelajaran Berbasis Masalah dengan Pendekatan Saintifik terhadap Keterampilan Berpikir Kritis Siswa. *Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, *5*(1), 20–24. https://doi.org/10.33394/j-ps.v5i1.1153

Nurdiana, N., Hunaepi, H., Ikhsan, M., Suwono, H., & Sulisetijono, S. (2023). Exploring curiosity and critical thinking skills for prospective biology teacher. *International Journal of Evaluation and Research in Education (IJERE)*, *12*(1), Article 1. https://doi.org/10.11591/ijere.v12i1.23302

Pramiasari, A. D., Muslim, A., & Supriatna, S. (2022). Problem-Based Learning in Elementary Schools: The Study Of Curiosity and Mathematics Communication Ability. *Journal of Innovation and Research in Primary Education*, *1*(1), Article 1. https://doi.org/10.56916/jirpe.v1i1.27

Stamarski, C. S., & Son Hing, L. S. (2015). Gender inequalities in the workplace: The effects of organizational structures, processes, practices, and decision makers’ sexism. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.01400

Suaedin, S., Hunaepi, H., & Mursali, S. (2014). EFEKTIVITAS MODEL PEMBELAJARAN BERBASIS MASALAH TERHADAP PENINGKATAN KEMAMPUAN BERPIKIR KREATIF DAN HASIL BELAJAR KOGNITIF SISWA. *Bioscientist : Jurnal Ilmiah Biologi*, *2*(1), 30–36. https://doi.org/10.33394/bioscientist.v2i1.1305

Suhirman, S., Yusuf, Y., Hunaepi, H., & Ikhsan, M. (2022). Scientific Curiosity of Biology Teacher Candidate. *Journal of Innovation in Educational and Cultural Research*, *3*(3), 405–411.

Trianto, & Suseno, H. (2017). *Desain Pengembangan Kurikulum 2013 di Madrasah, (Depok*. Kencana Prenada Media Grup.

Trullàs, J. C., Blay, C., Sarri, E., & Pujol, R. (2022). Effectiveness of problem-based learning methodology in undergraduate medical education: A scoping review. *BMC Medical Education*, *22*(1), 104. https://doi.org/10.1186/s12909-022-03154-8